DOCKET NO: 218222US0PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
TAKESHI MIYAKAWA, ET AL.	: EXAMINER: CHEVALIER, ALICIA A.
SERIAL NO: 10/030,160	: GROUP ART UNIT: 1772
FILED: JANUARY 30, 2002	: RCE FILED: OCTOBER 27, 2004
FOR: SHEET FOR AN EMBOSSED CARRIER TAPE	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal from the Final Rejection dated October 4, 2005, finally rejecting Claims 10-15 of the above-identified application.

I. REAL PARTY IN INTEREST

The real party in interest for this Appeal and the present application is Denki Kagaku Kogyo Kabushiki Kaisha, of Tokyo, Japan, by Assignment recorded January 30, 2002, at Reel/Frame: 012618/0584.

II. RELATED APPEALS AND INTERFERENCES

There are no prior and pending appeals, interferences or judicial proceedings known to Appellants, Appellants' legal representatives or the Assignee, which may be related to, directly affect or be directly affected by or have a bearing upon the Board's decision in the pending Appeal.

III. STATUS OF CLAIMS

Claims 10-15 are pending in this application. Claims 1-9 are canceled. Claims 10-15 have been twice rejected and are on appeal. The appealed claims are set forth in the attached Claims Appendix. Claims 10 and 15 are independent. Claims 11-14 depend from independent Claim 10.

IV. STATUS OF AMENDMENTS

No Amendments have been filed after the Final Rejection dated October 4, 2005.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention provides an embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3 and comprises at least one thermoplastic resin other than a polyphenylene ether resin. Specification at page 2, lines 1-4; page 3, line 27 to page 4, line 7.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 10-15 are rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,361,901 ("Schenz") in view of U.S. Patent No. 5,346,765 ("Maeda").

Claims 10-15 are rejected under 35 U.S.C. § 103(a) over Schenz in view of Japanese Laid Open Patent Publication No. Hei 8-258888 ("Miyamoto")(attached is an English-language translation, filed August 3, 2004, of Miyamoto).

VII. ARGUMENT

The present invention provides an embossed carrier tape that can be used for packaging electronic components such as integrated circuits. Specification at page 1, lines 4-7. An embossed carrier tape includes a sheet with embossed pockets for accommodating the electronic components. Specification at page 4, lines 24-27.

As the speed of mounting electronic components on substrates has increased, breakage of embossed carrier tapes has become a problem. Specification at page 1, lines 14-19. The present inventors have discovered that the breakage originates from tears at a flange corner portion or a sprocket hole portion of an embossed pocket of a carrier tape. Specification at page 1, lines 21-25. The present inventors have also discovered that the breakage of embossed carrier tapes during high speed mounting of electronic components on substrates can be significantly reduced by setting the tear strength of the sheet forming the embossed carrier tape to at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3. Specification at page 1, lines 14-19; page 2, lines 8-15; page 9, lines 4-6.

The removal of electronic components packaged in an embossed carrier tape is illustrated in Schenz at Figs. 1-2 and 4, which are reproduced below:

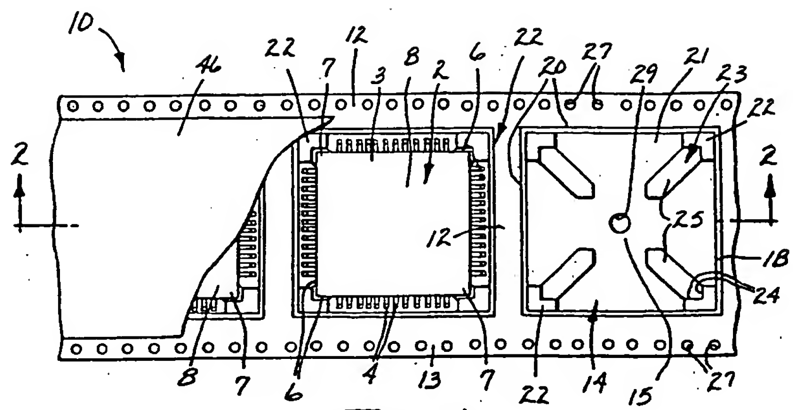

Fig. 1

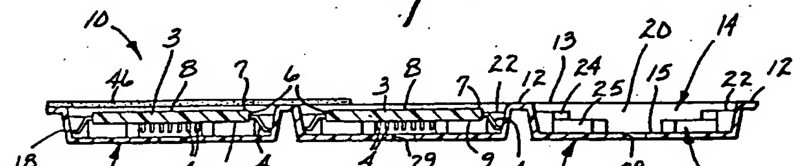

Fig. 2

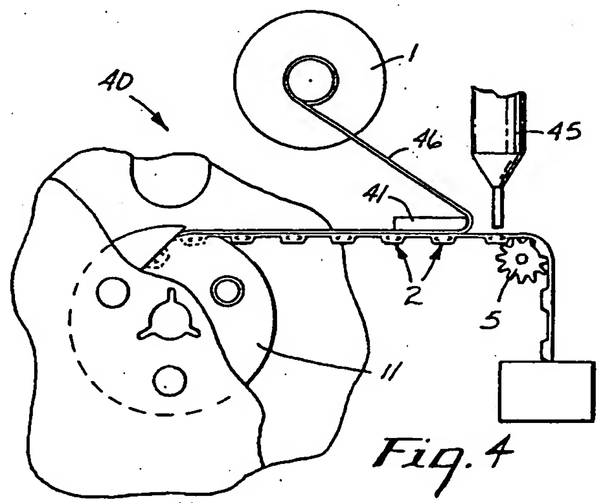

Fig. 4

Figs. 1-2 and 4 of Schenz show electronic components 2 secured by cover tape 46 in embossed pockets 14 of carrier tape 10. Drive sprocket 5 engages through openings 27 of carrier tape 10 to sequentially advance embossed pockets 14 while simultaneously unwinding carrier tape 10 from reel 11. Take up reel 1 peels adhesive cover tape 46 from the carrier tape 10 to expose electronic components 2. Vacuum pick-up 45 removes components 2 and places them on a circuit board (not shown).

A. Schenz in view of Maeda

1. Schenz in view of Maeda fails to suggest all the limitations of Claims 10-15

Schenz in view of Maeda fails to suggest the limitation of Claims 10-15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Schenz discloses a carrier tape that can be constructed from any suitable polymeric material. Schenz at title; column 5, lines 62-67. Schenz discloses that a removable cover strip 46 can be peeled from carrier tape 10 to expose a component 2. Schenz at column 6, lines 62-65; see Figs. 1-2 and 4, reproduced above. Schenz is directed to providing a carrier tape that maintains the desired orientation of the component 2 when the component 2 is assembled into a new product. Schenz at column 3, lines 52-56.

However Schenz is silent about the tear strength of the ***carrier tape***. The Final Rejection dated October 4, 2005, at page 2, section 3, lines 8-9, admits that Schenz fails to disclose that the sheet forming the carrier tape has a tear strength of at least 105 N/mm.

Maeda discloses a cover tape heat sealable to a plastic carrier tape having at given intervals pockets for accommodation of chip type electronic parts. Maeda at column 1, lines 6-9. Maeda discloses that a cover tape 1 includes an outer layer 2 and an adhesion layer 5, which contacts a carrier tape 6. Maeda at column 3, line 60 to column 4, line 12; Figs. 1-2. Maeda is concerned with the **peel-off strength *between*** the **cover tape** and the **carrier tape.**

> In recent years, chip type electronic parts used for surface mounting, such as ICs, transistors, diodes, condensers, piezoelectric resistors and the like have been supplied by being contained in packaging materials consisting of a plastic **carrier tape** having at given intervals pockets formed by embossing so as to accomodate chip type electronic parts of particular shape and a **cover tape** heat-sealable to the **carrier tape.** The electronic parts contained in the packaging materials are automatically taken out after **peeling** the **cover tape** of the package, and are mounted on the surface of an electronic circuit substrate.

> The strength when the **cover tape** is peeled off from the **carrier tape** is called **"peel-off strength"**. Maeda at column 1, lines 17-30 (emphasis added).

> **According to the present invention,** owing to the following three features, i.e., a feature that the adhesion layer has been subjected to an antistatic treatment, and hence generation of static electricity by the contact of the electronic parts with the **cover tape** or at the time of **cover tape** peeling is reduced, and the antistatic effect is stable against the use conditions or the lapse of time and has no influence on the sealing property of the **cover tape,** a feature that the **peel-off strength** can be set at a desired level in a range of **10-120 g per mm** by the combination of the adhesion layer and the outer layer or of the intermediate layer and the adhesion layer, and a feature that the **peel-off strength** is determined by the interlaminar adhesion strength within the **cover tape** and accordingly is not affected by the sealing conditions between the adhesion layer and the **carrier tape, it is possible to solve the conventional problems of a cover tape,** i.e., a problem that the **peel-off strength** is greatly affected by the sealing conditions, a problem that the **peel-off strength** changes with the lapse of time depending upon the storage conditions, and a problem that static electricity is generated by the contact of the electronic parts with the **cover tape** or at the time of cover tape peeling, and thereby it is possible to obtain a stable **peel-off strength.** Maeda at column 6, lines 19-44 (emphasis added).

> In this case, an adhesive is selected so that the **interlaminar adhesion strength** between the outer layer 2 and adhesion layer 5 of the **cover tape 1** becomes **10-120 g, preferably 10-70 g per 1 mm of sealing width.** Maeda at column 5, lines 58-62 (emphasis added).

Thus, Maeda is concerned with the **peel-off strength** (in grams force per mm of sealing width) ***between*** the **cover tape** and the **carrier tape.**

However, Maeda is silent about the **tear strength** (in N/mm) ***of*** the **carrier tape.**

Schenz in view of Maeda fails to suggest the limitation of independent Claims 10 and 15 of an "embossed **carrier tape** comprising a sheet having at least one embossed pocket, wherein the sheet ... has a **tear strength** of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Thus, Schenz in view of Maeda fails to have rendered obvious Claims 10-15.

2. No reasonable expectation of success

There is no reasonable expectation that Schenz in view of Maeda would have led the skilled artisan to the limitation of Claims 10-15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3", because there is no recognition in the cited prior art that tear strength is an important factor in avoiding carrier tape breakage during use.

As discussed above, Schenz is silent about the tear strength of carrier tape.

Maeda also ignores the importance of carrier tape tear strength, and, as discussed above, instead focuses on the peel-off strength between cover tape and carrier tape.

> In this case, an adhesive is selected so that the interlaminar adhesion strength between the outer layer 2 and adhesion layer 5 of the cover tape 1 becomes 10-120 g, preferably 10-70 g per 1 mm of sealing width. When the peeling strength is smaller than 10 g, there occurs a problem during the transportation of the package that the cover tape is spontaneously removed and the electronic parts contained in the package fall off. When the peeling strength is larger than 120 g, there occurs a phenomenon that the carrier tape undergoes vibration at the time of cover tape peeling and the electronic parts jump out of the pockets of the carrier tape right before the mounting of the electronic parts, i.e., jumping trouble. Maeda at column 5, line 58 to column 6, line 4.

Thus, Maeda is concerned with how a cover tape is peeled from a carrier tape. However, the strength with which a cover tape adheres to a carrier tape is practically unrelated to the strength of the carrier tape. While a carrier tape must withstand the stress of having a cover tape peeled from it, more importantly the carrier tape must withstand the stress of being pulled from a reel by a drive sprocket. See Figs. 1-2 and 4 of Schenz, reproduced above.

Appellants were the first to discover the importance in controlling tear strength (N/mm) to prevent carrier tape breakage. Controlling carrier tape strength (N) or carrier tape

tensile strength (N/mm^2) is not enough. This is shown in Table A from the Declaration Under 37 C.F.R. 1.132 filed July 11, 2005 (copy attached). Table A is reproduced below.

Table A

Item (unit)		Base layer	Surface layer	Sheet thickness (μm)	Tear strength (N/mm)	Carrier tape strength (N)	Carrier tape tensile strength (N/mm^2)
Examples	1	PC + CB		300	162	109	15
	2	ABS	PC + CB	200	143	82	17
	3	PET + CB		300	137	129	18
	4	ABS	PS (E640N) + CB	400	126	100	10
	5	MS (TP-URX) + CB		500	117	64	5.3
Comparative Examples	1	PS + CB		300	78	42	5.8
	2	MS (TP-SX) + CB		500	82	45	3.8
	3	ABS	PS (HRM-20) + CB	300	64	38	5.3
	4	PS(HRM20)	PC + CB	200	72	35	7.3

In Table A, Example 5 and Comparative Examples 1 and 4 have carrier tape tensile strengths (N/mm^2) of 5.3, 5.8 and 7.3, respectively, and tear strengths (N/mm) of 117, 78 and 72, respectively. These results show that even when carrier tape tensile strengths (N/mm^2) are comparable, tear strengths (N/mm) can sometimes become low. Thus, it is meaningful to define the lower limit of tear strength (N/mm).

In Examples 1-5 a carrier tape strength of at least 60 N was obtained, whereas in Comparative Examples 1-4 the carrier tape strength was less than 50 N. Specification at page 8, lines 13-15. With respect to each of the embossed carrier tapes of Examples 1-5 and Comparative Examples 1-4, a mounting test to emboss 100 pockets was carried out by using a mounting machine with a component mounting tact of 0.1 sec/component. Specification at page 8, lines 15-19. In Examples 1-5 the embossed carrier tape did not break, whereas in Comparative Examples 1-4 the embossed carrier tape broke. Specification at page 8, lines 19-22.

One might expect that simply increasing carrier tape thickness would prevent breakage. However, Table A shows that this is not the case. In Table A, Example 5 and Comparative Example 2 both have a sheet thickness of 500 μm. Example 5 and Comparative Example 2 are both obtained using styrene-methyl methacrylate copolymer resin and carbon black. Specification at page 5, line 8; page 7, lines 2-8; 18-23. Despite having similar compositions and the same thickness, the carrier tape of Comparative Example 2 broke during the mounting test discussed above, while the carrier tape of Example 5 did not. Table A shows that Comparative Example 2 has a tear strength of only 82 N/mm, while Example 5 has a tear strength of 117 N/mm. These results show that carrier tapes with similar compositions and thicknesses can have quite different breakage characteristics and that, with carrier tape composition and thickness essentially constant, a decrease in carrier tape breakage can be achieved by increasing tear strength to at least 105 N/mm.

Appellants were the first to discover that if tear strength is less than 105 N/mm, then carrier tape is likely to break. Specification at page 2, lines 11-15.

Because the cited prior art does not recognize the central role played by tear strength (N/mm) in reducing the likelihood of carrier tape breakage, there is no reasonable expectation that the cited prior art would have led the skilled artisan to the limitation of independent Claims 10 and 15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Thus, Schenz in view of Maeda fails to have rendered obvious Claims 10-15.

3. Any *prima facie* case of obviousness is rebutted

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant increase in the strength of embossed carrier tape (units N) that is achieved by the

present invention over the range defined Claims 10-15 where "the sheet ... has a tear strength of at least 105 N/mm as defined by Japanese Industrial Standard K-7128-3".

Table B from the Declaration Under 37 § 1.132 filed July 11, 2005, is reproduced below.

Table B

	Sheet		Embossed carrier tape
	Tensile breakage strength	Tear strength	Strength
(Unit)	(N/mm^2)	(N/mm)	(N)
Sample 1	35	171	71
Sample 2	33	70	33

In Table B, the tensile breakage strengths (N/mm^2) of the sheets in Samples 1 and 2 are about the same. However, the tear strengths of the sheets in Samples 1 and 2 are 171 and 70 N/mm, respectively, and the strengths of the embossed carrier tapes in Samples 1 and 2 are 71 and 33, respectively. Table B show that, for essentially constant sheet tensile breakage strength (N/mm^2), increasing the sheet tear strength to at least 105 N/mm results in a significant improvement in the strength of the embossed carrier tape, which leads to less carrier tape breakage during use.

The cited prior art is silent about this effect of the present invention of significantly increasing the strength of the embossed carrier tape, and thus reducing the likelihood of breakage, by controlling the tear strength to be at least 105 N/mm.

Thus, any *prima facie* case of obviousness based on the cited prior art is rebutted.

As a result, Schenz in view of Maeda fails to have rendered obvious Claims 10-15.

B. Schenz in view of Miyamoto

1. Schenz in view of Miyamoto fails to suggest all the limitations of Claims 10-15

Schenz in view of Miyamoto fails to suggest the limitation of Claims 10-15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Schenz discloses a carrier tape that can be constructed from any suitable polymeric material. Schenz at title; column 5, lines 62-67. Schenz discloses that a removable cover strip 46 can be peeled from carrier tape 10 to expose a component 2. Schenz at column 6, lines 62-65; see Figs. 1-2 and 4, reproduced above. Schenz is directed to providing a carrier tape that maintains the desired orientation of the component 2 when the component 2 is assembled into a new product. Schenz at column 3, lines 52-56.

However Schenz is silent about the tear strength of the ***carrier tape***. The Final Rejection dated October 4, 2005, at page 2, section 3, lines 8-9, admits that Schenz fails to disclose that the sheet forming the carrier tape has a tear strength of at least 105 N/mm.

Miyamoto discloses a ***cover tape*** having an outer layer, an intermediate layer and an adhesive layer, where the intermediate layer has a tear strength (JIS K-7128) of at least 100 kg/cm. English-language translation of Miyamoto at [0006].

However, a ***cover tape*** is not a ***carrier tape***.

Schenz in view of Miyamoto fails to suggest the limitation of independent Claims 10 and 15 of an "embossed ***carrier tape*** comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Thus, Schenz in view of Miyamoto fails to have rendered obvious Claims 10-15.

2. No reasonable expectation of success

There is no reasonable expectation that Schenz in view of Miyamoto would have led the skilled artisan to the limitation of Claims 10-15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3", because there is no recognition in the cited prior art that tear strength is an important factor in avoiding carrier tape breakage during use.

As discussed above, Schenz is silent about the tear strength of carrier tape.

Miyamoto also ignores the importance of carrier tape tear strength, and instead focuses on the strength of the cover tape.

> [S]ome trouble is frequently occurred in which the cove[r] tape can no longer endure the stress at the time of peeling and thus is broken, namely "tape breakage", and becomes a main cause of the yield in production. English-language translation of Miyamoto at [0003], lines 1-5.

Thus, Miyamoto is only concerned with the strength of cover tape. However, the forces encountered by a cover tape are quite different than the forces encountered by a carrier tape. While a cover tape must withstand the stress of being peeled away from a carrier tape, the carrier tape must withstand the stress of being pulled from a reel by a drive sprocket. See Figs. 1-2 and 4 of Schenz, reproduced above.

Appellants were the first to discover the importance in controlling tear strength (N/mm) to prevent carrier tape breakage. Controlling carrier tape strength (N) or carrier tape tensile strength (N/mm^2) is not enough. This is shown in Table A from the Declaration Under 37 C.F.R. 1.132 filed July 11, 2005 (copy attached). Table A is reproduced below.

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Item (unit)		Base layer	Surface layer	Sheet thickness (μm)	Tear strength (N/mm)	Carrier tape strength (N)	Carrier tape tensile strength (N/mm^2)
Examples	1	PC + CB		300	162	109	15
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	4	PS(HRM20)	PC + CB	200	72	35	7.3

In Table A, Example 5 and Comparative Examples 1 and 4 have carrier tape tensile strengths (N/mm^2) of 5.3, 5.8 and 7.3, respectively, and tear strengths (N/mm) of 117, 78 and 72, respectively. These results show that even when carrier tape tensile strengths (N/mm^2) are comparable, tear strengths (N/mm) can sometimes become low. Thus, it is meaningful to define the lower limit of tear strength (N/mm).

In Examples 1-5 a carrier tape strength of at least 60 N was obtained, whereas in Comparative Examples 1-4 the carrier tape strength was less than 50 N. Specification at page 8, lines 13-15. With respect to each of the embossed carrier tapes of Examples 1-5 and Comparative Examples 1-4, a mounting test to emboss 100 pockets was carried out by using a mounting machine with a component mounting tact of 0.1 sec/component. Specification at page 8, lines 15-19. In Examples 1-5 the embossed carrier tape did not break, whereas in Comparative Examples 1-4 the embossed carrier tape broke. Specification at page 8, lines 19-22.

One might expect that simply increasing carrier tape thickness would prevent breakage. However, Table A shows that this is not the case. In Table A, Example 5 and

Comparative Example 2 both have a sheet thickness of 500 μm. Example 5 and Comparative Example 2 are both obtained using styrene-methyl methacrylate copolymer resin and carbon black. Specification at page 5, line 8; page 7, lines 2-8; 18-23. Despite having similar compositions and the same thickness, the carrier tape of Comparative Example 2 broke during the mounting test discussed above, while the carrier tape of Example 5 did not. Table A shows that Comparative Example 2 has a tear strength of only 82 N/mm, while Example 5 has a tear strength of 117 N/mm. These results show that carrier tapes with similar compositions and thicknesses can have quite different breakage characteristics and that, with carrier tape composition and thickness essentially constant, a decrease in carrier tape breakage can be achieved by increasing tear strength to at least 105 N/mm.

Appellants were the first to discover that if tear strength is less than 105 N/mm, then carrier tape is likely to break. Specification at page 2, lines 11-15.

Because the cited prior art does not recognize the central role played by tear strength (N/mm) in reducing the likelihood of carrier tape breakage, there is no reasonable expectation that the cited prior art would have led the skilled artisan to the limitation of independent Claims 10 and 15 of an "embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet ... has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3".

Thus, Schenz in view of Miyamoto fails to have rendered obvious Claims 10-15.

3. Any *prima facie* case of obviousness is rebutted

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant increase in the strength of embossed carrier tape (units N) that is achieved by the present invention over the range defined Claims 10-15 where "the sheet ... has a tear strength of at least 105 N/mm as defined by Japanese Industrial Standard K-7128-3".

Table B from the Declaration Under 37 § 1.132 filed July 11, 2005, is reproduced below.

Table B

	Sheet		Embossed carrier tape
	Tensile breakage strength	Tear strength	Strength
(Unit)	(N/mm^2)	(N/mm)	(N)
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In Table B, the tensile breakage strengths (N/mm^2) of the sheets in Samples 1 and 2 are about the same. However, the tear strengths of the sheets in Samples 1 and 2 are 171 and 70 N/mm, respectively, and the strengths of the embossed carrier tapes in Samples 1 and 2 are 71 and 33, respectively. Table B show that, for essentially constant sheet tensile breakage strength (N/mm^2), increasing the sheet tear strength to at least 105 N/mm results in a significant improvement in the strength of the embossed carrier tape, which leads to less carrier tape breakage during use.

The cited prior art is silent about this effect of the present invention of significantly increasing the strength of the embossed carrier tape, and thus reducing the likelihood of breakage, by controlling the tear strength to be at least 105 N/mm.

Thus, any *prima facie* case of obviousness based on the cited prior art is rebutted.

As a result, Schenz in view of Miyamoto fails to have rendered obvious Claims 10-15.

D. Conclusion

For the reasons discussed above, Appellants respectfully request that the Final Rejection of Claims 10-15 be REVERSED.

Respectfully submitted,

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MAIER & NEUSTADT, P.C.
Norman F. Oblon

Corwin Paul Umbach

Corwin P. Umbach, Ph.D.
Registration No. 40,211

Attached:
- Claims Appendix
- Evidence Appendix
- Related Proceedings Appendix

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VIII. CLAIMS APPENDIX

Claims 1-9 (Canceled)

Claim 10 (Previously Presented): An embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet has a tear strength of at least 105 N/mm as defined in Japanese Industrial Standard K-7128-3 and comprises at least one thermoplastic resin other than a polyphenylene ether resin.

Claim 11 (Previously Presented): The embossed carrier tape according to Claim 10, wherein at least one surface of the sheet has a surface resistance of at most 10^{12} Ω/□.

Claim 12 (Previously Presented): The embossed carrier tape according to Claim 11, wherein the sheet is a single-layer sheet.

Claim 13 (Previously Presented): The embossed carrier tape according to Claim 11, wherein the sheet is a multi-layer sheet.

Claim 14 (Previously Presented): The embossed carrier tape according to Claim 13, wherein the sheet has a base layer and an electrically conductive surface layer.

Claim 15 (Previously Presented): An embossed carrier tape comprising a sheet having at least one embossed pocket, wherein the sheet comprises a thermoplastic resin, has a base layer and a surface layer having a surface resistance of at most 10^{12}Ω/□ on both sides of the base layer, and has a tear strength of at least 105 N/mm as defined the Japanese Industrial Standard K-7128-3.

IX. EVIDENCE APPENDIX

1. English-language translation, filed August 3, 2004, of Japanese Laid Open Patent Publication No. Hei 8-258888 ("Miyamoto").

2. Declaration Under 37 C.F.R. 1.132 filed July 11, 2005.

X. RELATED PROCEEDINGS APPENDIX

None

SEP 27 2006
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OSMM&N File No. 218222US0PCT

Dept.: Cher 1

By: NFO/CPU/pae

Serial No. 10/030,160

In the matter of the Application of: Takeshi MIYAKAWA, et al.

For: SHEET FOR AN EMBOSSED CARRIER TAPE

Due Date: July 10, 2005

The following has been received in the U.S. Patent Office on the date stamped hereon:

- Dep. Acct. Order Form
- Credit Card form for $1,020.00
- Amendment Cover Letter
- Petition for Extension of Time 3-month
- Request for Reconsideration
- Rule 132 Declaration (signed facsimile copy)
- Unfaxed copy of Fig. 1 from Rule 132 Declaration

JUL 11 2005
PATENT & TRADEMARK OFFICE

DOCKET NO: 218222US0PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

TAKESHI MIYAKAWA, ET AL. : EXAMINER: CHEVALIER, ALICIA A.

SERIAL NO: 10/030,160 : GROUP ART UNIT: 1772

FILED: JANUARY 30, 2002 : RCE FILED: OCTOBER 27, 2004

FOR: SHEET FOR AN EMBOSSED CARRIER TAPE :

DECLARATION UNDER 37 C.F.R. § 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

I, Takeshi Miyakawa, a citizen of Japan, hereby declare and state that:

1. I am a co-inventor of the above-identified application.

2. The specification discloses tear strength and carrier tape strength for Examples 1-5 and Comparative Examples 1-4 at page 9, Table 1, which is reproduced in Table A below.

Table A

Item (unit)		Base layer	Surface layer	Sheet thickness (μm)	Tear strength (N/mm)	Carrier tape strength (N)	Carrier tape tensile strength (N/mm²)
Examples	1	PC + CB		300	162	109	15
	2	ABS	PC + CB	200	143	82	17
	3	PET + CB		300	137	129	18
	4	ABS	PS (E640N) + CB	400	126	100	10
	5	MS (TP-URX) + CB		500	117	64	5.3
Comparative Examples	1	PS + CB		300	78	42	5.8
	2	MS (TP-SX) + CB		500	82	45	3.8
	3	ABS	PS (HRM-20) + CB	300	64	38	5.3
	4	PS(HRM20)	PC + CB	200	72	35	7.3

As discussed in the specification at page 8, lines 13-22, in Examples 1-5 a carrier tape strength of at least 60 N was obtained, whereas in Comparative Examples 1-4 the carrier tape strength was less than 50 N. With respect to each of the embossed carrier tapes of Examples 1-5 and Comparative Examples 1-4, a mounting test for emboss 100 pockets was carried out by using a mounting machine with a component mounting tact of 0.1 sec/component. In Examples 1-5 the embossed carrier tape did not break, whereas in Comparative Examples 1-4 the embossed carrier tape broke.

In addition to the tear strength (N/mm) and carrier tape strength (N) data found in Table 1, Table A includes carrier tape tensile strength (N/mm²) data for Examples 1-5 and Comparative Examples 1-4. The carrier tape tensile strength data was obtained using the following formula (tape width = 24 mm, specification at page 5, line 15):

carrier tape tensile strength = (carrier tape strength)/[(sheet thickness)(tape width)]

In Example 1, e.g., carrier tape tensile strength = 15 N/mm² ($=(109)/[(300\text{x}10^{-3})(24)]$).

Table A shows that in Example 5, the carrier tape tensile strength is 5.3 N/mm^2 and the tear strength of the sheet is 117 N/mm. In Comparative Example 1, the carrier tape tensile strength is 5.8 N/mm^2 and the tear strength is 78 N/mm. In Comparative Example 4, the carrier tape tensile strength is 7.3 N/mm^2 and the tear strength is 72 N/mm. These results indicate that even when the tensile strengths of the carrier tapes are at the same level, the tear strengths thereof may sometimes become low. Thus, it is meaningful to define the lower limit of the tear strength.

3 . Results of experiments

The following experiments were carried out by me or under my direct supervision and control.

(1) Purpose

In the present invention, by using a sheet having a tear strength of at least 105 N/mm as defined in JIS-K-7128-3, it is possible to obtain an embossed carrier tape useful for high-speed mounting. In the following experiments, in relation to the breakage of the embossed carrier tape, the tensile breakage strength and tear strength of the sheet and the tensile strength of the embossed carrier tape were measured, and the relations were studied.

(2) Experiments

(2-1) Materials used

A: "SE-10", ABS resin, manufactured by Denki Kagaku Kogyo K.K.

B: "E640N", PS resin, manufactured by Toyo Styrene Co., Ltd.

C: Acetylene black grains, carbon black manufactured by Denki Kagaku Kogyo K.K.

D: "APT-3010", ABS resin manufactured by Denki Kagaku Kogyo K.K.

E: Electrically conductive compound resin obtained by preliminarily kneading B and C at the ratio of B:C=80:20 by mass% and pelletizing it by means of a ϕ 50 mm vent type biaxial extruder.

(2-2) Preparation of samples

Sample 1: Using A as a base layer and E as a surface layer, by means of a feed block method using a ϕ 65 mm extruder (L/D=28) and a ϕ 40 mm extruder (L/D=26) and a T-dye having a width of 500 mm, a sheet for an embossed carrier tape, having a total thickness of 200 μm and a thickness of each electrically conductive resin composition layer of 20 μm at both sides of the base layer was produced. This sheet was slit into a width of 24 mm to obtain an embossed carrier tape having pocket size of 12 mm × 15 mm × 5.5 mm and having a width of 24 mm by means of a carrier tape forming machine manufactured by EDG.

Sample 2: Using D as a base layer and D as a surface layer, by means of a feed block method using a ϕ 65 mm extruder (L/D=28) and a T-dye having a width of 500 mm, a sheet for an embossed carrier tape, having a total thickness of 200 μm was produced. From this sheet, an embossed carrier tape was produced in the same manner as in the above process for producing Sample 1.

(2-3) Method of evaluation (see attached Fig. 1 for reference)

(2-3-1) Tensile breakage strength was measured in accordance with JIS-K-7127, and the sheet for an embossed carrier tape was subjected to a tensile test by means of a strograph tensile tester using a number 4 test piece at a tensile rate of 10 mm/min.

(2-3-2) Tear strength was measured in accordance with JIS-K-7128-3, and the sheet for an embossed carrier tape was subjected to a tensile test by means of a strograph tensile tester at a tensile rate of 200 mm/min.

(2-3-3) Strength of the embossed carrier tape was measured by a tensile test by means of an autograph tensile tester with a chuck space of 32 mm at a tensile rate of 10 mm/min.

(3) Results

Table B

	Sheet		Embossed carrier tape
	Tensile breakage strength	Tear strength	Strength
(Unit)	(N/mm^2)	(N/mm)	(N)
Sample 1	35	171	71
Sample 2	33	70	33

(4) Conclusion

In Samples 1 and 2 the tensile breakage strength of the sheet is about the same. However, in Sample 2 the tear strength of the sheet is about 41% (= (70/171)(100)) that of Sample 1, and the strength of the embossed carrier tape is about 46% (= (33/71)/(100)) that of Sample 1.

The results in Table B show that the strength of the embossed carrier tape can be significantly improved by increasing the tear strength of the sheet to at least 105 N/mm.

4 . I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

5 . Further declarant saith not.

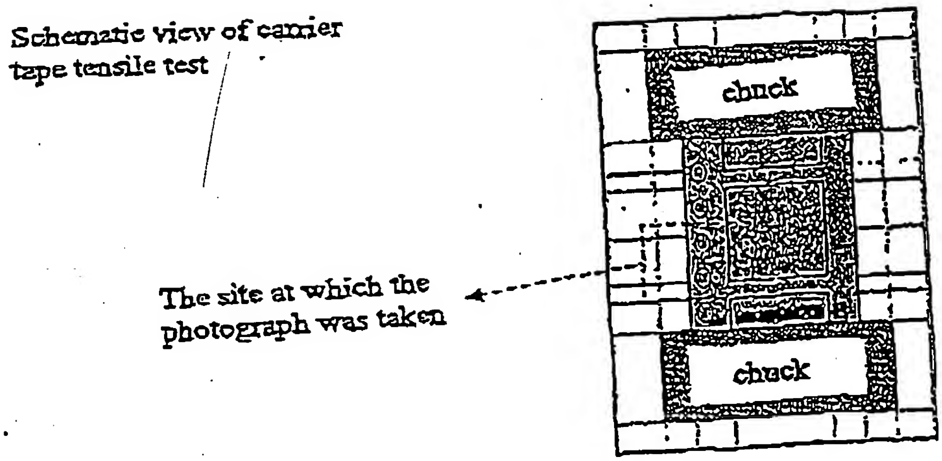
Date: 08/07/2005

Takeshi Miyakawa

Takeshi Miyakawa

Attached: Fig. 1

Report of experiment (photograph)



Photographs before and after the measurement of carrier tape strength
Method: by microscope (Toyo Seiki K.K.)
Magnification: x 1.0 time

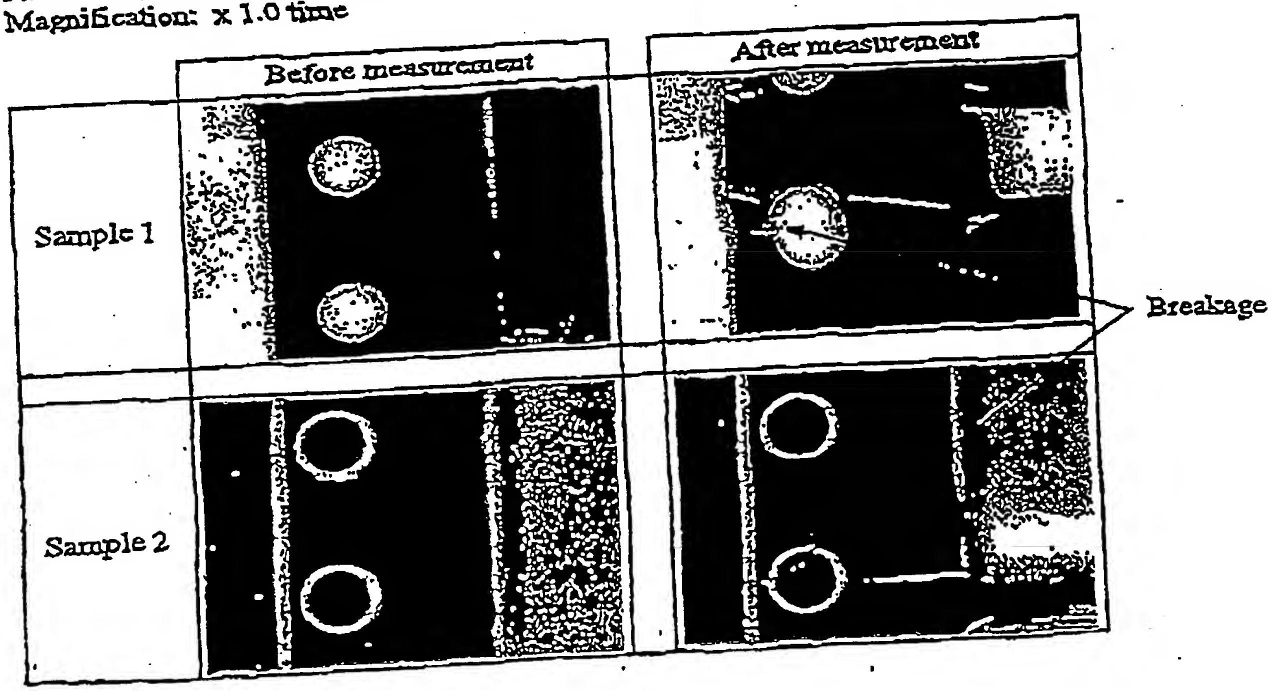
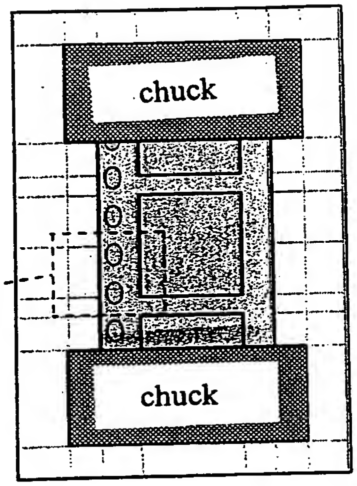


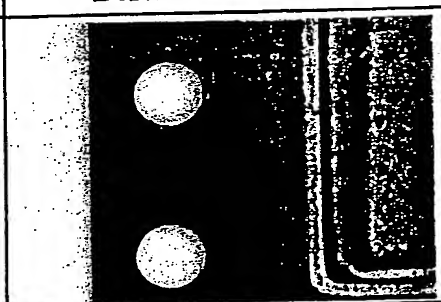
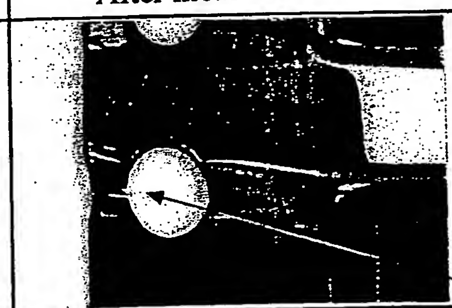
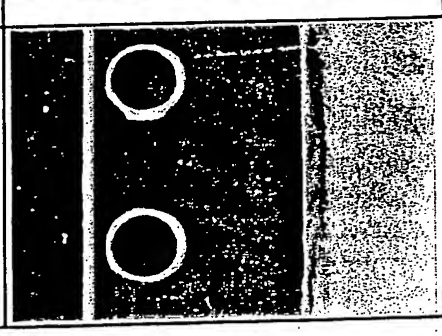
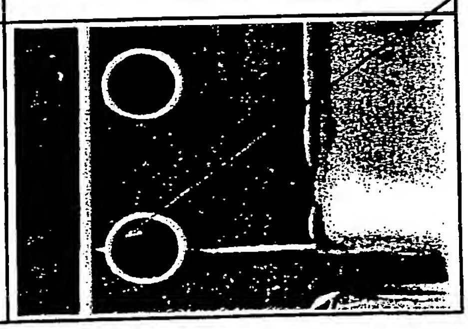
Fig. 1

Report of experiment (photograph)

Schematic view of carrier tape tensile test



Photographs before and after the measurement of carrier tape strength
Method: by microscope (Toyo Seiki K.K.)
Magnification: x 1.0 time

	Before measurement	After measurement
Sample 1		
Sample 2		

Breakage

Fig. 1

Dept.: C
By: NFO/CPU/scs

OSMM&N File No. 218222US0PCT
Serial No. 10/030,160
In the matter of the Application of: Takeshi MIYAKAWA, et al.
For: SHEET FOR AN EMBOSSED CARRIER TAPE

Due Date: 8/11/04

The following has been received in the U.S. Patent Office on the date stamped hereon:

- Dep. Acct. Order Form
- PTO Transmittal Letter
- Amendment After Final Rejection w/attachment
  - English-language translation of Japanese Patent Application No. 08258888 ("Miyamoto")

(Translation of Laid Open Hei 8-258888)

(19) Japanese Patent Office (JP)

(11) Laid Open Patent Publication No. Hei 8-258888

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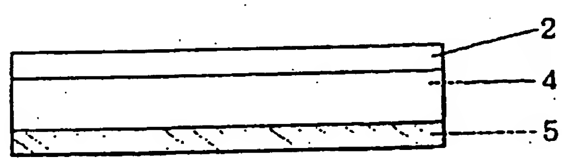
(54) [Title of the Invention] Cover tape for embossed carrier tape for surface mounting

(57) [ABSTRACT] (amended)

[Constitution]

A cover tape for embossed carrier tape for surface mounting which comprises an outer layer, an intermediate layer and an adhesive layer, wherein the outer layer is a biaxially oriented film of polyester or polypropylene; the intermediate layer is made of an ethylene-αolefin copolymer having a tear strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 kg-cm/cm^2 and an opaqueness (JIS K 7105) of at most 15%; and the adhesive layer is made of an adhesive which is heat-sealable to a plastic carrier tape and which is any one of a polyurethane type resin, an acrylic type resin, a polyvinyl chloride type resin, an ethylene vinyl acetate type resin, a polyester type resin, a butadiene type resin and a styrene type resin, or a combination thereof, wherein an electroconductive fine powder of tin oxide or zinc oxide is dispersed in the adhesive.



2: Outer layer, 4: Intermediate layer, 5: Adhesive layer

[Effect]

No trouble of tape breakage occurs even when high speed operation of a mounting machine progress.

[Scope of Claim(s)]

[Claim 1] A cover tape for an embossed carrier tape for surface mounting, which is a cover tape heat-sealable to a plastic carrier tape having continuously formed thereon pockets for accommodating chip type electronic components, wherein the cover tape comprises an outer layer, an intermediate layer and an adhesive layer, wherein the outer layer is a biaxially oriented film of polyester or polypropylene; the intermediate layer is made of an ethylene-α olefin copolymer having a tear strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 kg-cm/cm^2 and an opaqueness (JIS K 7105) of at most 15%; and the adhesive layer is made of an adhesive which is heat-sealable to a plastic carrier tape and which is any one of a polyurethane type resin, an acrylic type resin, a polyvinyl chloride type resin, an ethylene vinyl acetate type resin, a polyester type resin, a butadiene type resin and a styrene type resin, or a combination thereof, wherein an electroconductive fine powder of tin oxide or zinc oxide is dispersed in the adhesive, the electroconductive fine powder is added in an amount of from 10 to 1000 parts by weight based on 100 parts by weight of a base resin of the adhesive, a surface resistivity of the adhesive layer is at most 10^{13} $\Omega/\square$, a bonding strength between the adhesive layer of the cover tape and a sealing face of the carrier

tape is larger than an interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape, the interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape is 10 to 130 gr per 1 mm of the width of sealing, and the cover tape has a total light transmittance of at least 70% and a tensile impact strength of at least 400 $kg\text{-}cm/cm^2$.

[Claim 2] A cover tape for an embossed carrier tape for surface mounting, which is a cover tape heat-sealable to a plastic carrier tape having continuously formed thereon pockets for accommodating chip type electronic components, wherein the cover tape comprises an outer layer, a second layer at its inside, an intermediate layer at its inside and an adhesive layer, wherein the outer layer is a biaxially oriented film of polyester or polypropylene; the second layer is an oriented or non-oriented film of polypropylene or nylon; the intermediate layer is made of an ethylene-αolefin copolymer having a tear strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 $kg\text{-}cm/cm^2$ and an opaqueness (JIS K 7105) of at most 15%; and the adhesive layer is made of an adhesive which is heat-sealable to a plastic carrier tape and which is any one of a polyurethane type resin, an acrylic type resin, a polyvinyl chloride type resin, an ethylene vinyl acetate type resin, a polyester type resin, a butadiene type resin and a styrene type resin, or a combination thereof, wherein an electroconductive fine powder of tin oxide or zinc oxide is dispersed in the adhesive, the

electroconductive fine powder is added in an amount of from 10 to 1000 parts by weight based on 100 parts by weight of a base resin of the adhesive, a surface resistivity of the adhesive layer is at most 10^{13} Ω/□, a bonding strength between the adhesive layer of the cover tape and a sealing face of the carrier tape is larger than an interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape, the interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape is 10 to 130 gr per 1 mm of the width of sealing, and the cover tape has a total light transmittance of at least 70% and a tensile impact strength of at least 400 kg-cm/cm^2.

[Claim 3] The cover tape for an embossed carrier tape for surface mounting according to Claim 1 or 2, wherein the resin of the ethylene-α olefin copolymer of the intermediate layer is obtained by polymerization by means of a catalyst of zirconocene dichloride and methylaluminoxane.

[Claim 4] The cover tape for an embossed carrier tape for surface mounting according to Claim 1, 2 or 3, wherein the resin of the ethylene-α olefin copolymer of the intermediate layer has a density of 0.900 to 0.925 g/cm^3, a melting point of at least 110℃, and a molecular weight ratio (degree of polydispersion) defined by a ratio of weight average molecular weight (Mw)/number average molecular weight (Mn) is at most 3.

[Detailed Description of the Invention]

[0001]

[Industrial Field of Utilization]

The present invention relates to a cover tape heat-sealable to an embossed plastic carrier tape having pockets formed thereon, among the packaging having functions of protecting chip type electronic components from staining, aligning them so as to mount them on an electronic circuit board, and taking them out therefrom, at the time of storing, transporting and mounting the chip type electronic components.

[0002]

[Prior Art]

In recent years, chip type electronic components for surface mounting, for example, IC such as memories and logics, transistors, diodes and condensers, are packaged for service by a package which is constituted by an embossed plastic carrier tape having continuously formed thereon emboss-formed pockets which are capable of accommodating the electronic components depending upon their shapes, and a cover tape which is heat-sealable to the carrier tape. After the cover tape of the package is peeled off, the electronic components as the accommodated contents are automatically taken out and subjected to surface mounting on the electronic circuit board. The mounting techniques have been developed highly and precisely year by year, whereby the production efficiency is increased. Accordingly, the mounting speed of the electronic components has also been rapidly increased, and along this tendency, the installation for mounting has been modified so as to tightly rewind the cover tape, so that when the cover tape is peeled off to take out the electronic components at the time of mounting,

the cover tape will be securely taken out without failure in peeling. Further, the mounting tact reached to a very high speed level of at most 0.1 second/tact, and a mechanism in which the cover tape is spontaneously peeled off in at most 0.1 second becomes a mainstream. Accordingly, the cover tape is spontaneously peeled off by a very large power and subjected to a load of impact force larger than the ones conventionally given.

[0003]

Under such circumstances, recently, some trouble is frequently occurred in which the cove tape can no longer endure the stress at the time of peeling and thus is broken, namely "tape breakage", and becomes a main cause of the yield in production. Conventionally, the mounting speed is not so high and does not cause serious trouble, and as a measure for it, only an outer layer having a high mechanical strength is made thick. Most of cover tapes available in the market at present are simply constituted by two layers of a substrate layer/a sealant layer. However, since the overriding property of the sealant is a low temperature sealing property with the carrier tape, a resin being relatively flexible and having a low heat resistant and a low mechanical strength is chosen for this purpose. As the resin having excellent tear strength and impact strength as the sealant, low density olefins such as LLDPE and VLDPE may be mentioned. However, these resins have wide ranges of molecular weight and composition, and exhibit odor and tackiness of a film in a low molecular weight range, and

hindrance in a heat sealing property and poor transparency in a high molecular weight range, and thus the resistance to the tape breakage used to rely on the mechanical strength of the outer layer. However, if the outer layer becomes overly thick, the sealing property at a low temperature tends to be worsened, and there is a limit in such measures only with the thickness of the outer layer made of a single layer. Accordingly, when a very strong sealing is applied, if the tape is notched, tape breakage occurs and sufficient measures can not be conducted.

[0004]

[Problems that the Invention is to Solve]

In order to solve the above-mentioned problems, the present invention provides a cover tape which perfectly prevents the tape breakage when the cover tape is peeled off at the time of mounting, and at the same time, does not impair the low temperature sealing property and transparency, and has excellent mechanical strength, and which is heat-sealable to the embossed plastic carrier tape.

[0005]

[Means of Solving the Problems]

The present inventors have obtained a finding that a cover tape having excellent properties can be obtained from a composite film which comprises an outer layer, an intermediate layer at its inside, and an adhesive layer, wherein the outer layer is a biaxially oriented film; the intermediate layer is made of an ethylene-α olefin copolymer being excellent in a tear strength, an impact strength and a transparency and obtained

by means of a metallocene catalyst; and the adhesive layer has a structure obtained by coating a thermoplastic adhesive of a heat seal lacquer type having an electroconductive fine powder dispersed therein and has a surface resistivity of the adhesive layer of at most 10^{13} Ω and a total light transmittance of at least 70%; or a composite film which comprises an outer layer, a layer at its inside, being excellent in impact strength, an intermediate layer at its inside, and an adhesive layer, wherein the outer layer is a biaxially oriented film; the intermediate layer is made of an ethylene-α olefin copolymer being excellent in a tear strength, an impact strength and a transparency and obtained by means of a metallocene catalyst; and the adhesive layer has a structure obtained by coating a thermoplastic adhesive of a heat seal lacquer type having an electroconductive fine powder dispersed therein and has a surface resistivity of the adhesive layer of at most 10^{13} Ω and a total light transmittance of at least 70%. The present inventors have accomplished the present invention based on this discovery.

[0006]

Namely, the present invention provides:

A cover tape for an embossed carrier tape for surface mounting, which is a cover tape heat-sealable to a plastic carrier tape having continuously formed thereon pockets for accommodating chip type electronic components, wherein the cover tape comprises an outer layer, an intermediate layer and an adhesive layer, wherein the outer layer is a biaxially oriented film of polyester or polypropylene; the intermediate

layer is made of an ethylene-α olefin copolymer having a tear strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 kg-cm/cm^2 and an opaqueness (JIS K 7105) of at most 15%, and in which the resin of the copolymer has a density of 0.900 to 0.925 g/cm^3, a melting point of at most 110℃ and a molecular weight ratio as defined by a weight average molecular weight (Mw)/a number average molecular weight (Mn) of at most 3, and is obtainable by polymerization by means of a metallocene catalyst; and the adhesive layer is made of an adhesive which is heat-sealable to a plastic carrier tape and which is any one of a polyurethane type resin, an acrylic type resin, a polyvinyl chloride type resin, an ethylene vinyl acetate type resin, a polyester type resin, a butadiene type resin and a styrene type resin, or a combination thereof, wherein an electroconductive fine powder of tin oxide or zinc oxide is dispersed in the adhesive, the electroconductive fine powder is added in an amount of from 10 to 1000 parts by weight based on 100 parts by weight of a base resin of the adhesive, a surface resistivity of the adhesive layer is at most 10^{13} $\Omega/\square$, a bonding strength between the adhesive layer of the cover tape and a sealing face of the carrier tape is larger than an interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape, the interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape is 10 to 130 gr per 1 mm of the width of sealing, and the cover tape has a total light transmittance of at least 70% and a tensile impact strength of

at least 400 kg-cm/cm^2, and

A cover tape for an embossed carrier tape for surface mounting, which is a cover tape heat-sealable to a plastic carrier tape having continuously formed thereon pockets for accommodating chip type electronic components, wherein the cover tape comprises an outer layer, a second layer at its inside, an intermediate layer at its inside and an adhesive layer, wherein the outer layer is a biaxially oriented film of polyester or polypropylene; the second layer is an oriented or non-oriented film of polypropylene or nylon; the intermediate layer is made of an ethylene-αolefin copolymer having a tear strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 kg-cm/cm^2 and an opaqueness (JIS K 7105) of at most 15%, and in which the resin of the copolymer has a density of 0.900 to 0.925 g/cm^3, a melting point of at most 110℃ and a molecular weight ratio as defined by a weight average molecular weight (Mw)/a number average molecular weight (Mn) of at most 3, and is obtainable by polymerization by means of a metallocene catalyst; and the adhesive layer is made of an adhesive which is heat-sealable to a plastic carrier tape, and which is any one of a polyurethane type resin, an acrylic type resin, a polyvinyl chloride type resin, an ethylene vinyl acetate type resin, a polyester type resin, a butadiene type resin and a styrene type resin, or a combination thereof, wherein an electroconductive fine powder of tin oxide or zinc oxide is dispersed in the adhesive, the electroconductive fine powder is added in an amount of from 10

to 1000 parts by weight based on 100 parts by weight of a base resin of the adhesive, a surface resistivity of the adhesive layer is at most 10^{13} Ω/□, a bonding strength between the adhesive layer of the cover tape and a sealing face of the carrier tape is larger than an interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape, the interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape is 10 to 130 gr per 1 mm of the width of sealing, and the cover tape has a total light transmittance (JIS K 7105) of at least 70% and a tensile impact strength of at least 400 kg-cm/cm^2.

In each structure, the resin of the ethylene-α olefin copolymer of the intermediate layer is obtainable by polymerization by means of a zirconocene dichloride and methyl aluminoxane as catalysts.

[0007]

[Operation]

The constituting elements of a cover tape 1 of the present invention will be explained with reference to Figs. 1 and 2. In Fig. 1, an outer layer 2 is a biaxially oriented film of either one of a biaxially oriented polyester film and a biaxially oriented polypropylene film, and has a thickness of 6 to 25 μm, excellent transparency and heat resistance, and rigidity. If the outer layer is less than 6 μm in thickness, the rigidity tends to be lost, and if it exceeds 25 μm, this layer is likely too hard and the seal will be instable. An intermediate layer 4 is made of an ethylene-α olefin copolymer having a tear

strength (JIS K 7128) of at least 100 kg/cm, a tensile impact strength (ASTM D 1822) of at least 100 kg-cm/cm^2 and an opaqueness (JIS K 7105) of at most 15%, wherein the resin of the copolymer has a density of 0.900 to 0.925 g/cm^3, are melting point of at least 110°C, and a molecular weight ratio (degree of polydispersion) defined by a ratio of weight average molecular weight (Mw)/number average molecular weight (Mn) of at most 3, is obtained by polymerization by means of a metallocene catalyst. If the tensile strength is less than 100 kg/cm or the tensile impact strength is less than 100 kg-cm/cm, there is a risk of occurrence of tape breakage since it cannot endure the impact force at the time of high speed peeling. Further, if the opaqueness exceeds 15%, the transparency of the cover tape is remarkably reduced in its entirety, whereby the visibility of the device is reduced. If the density of the ethylene-α olefin copolymer as the intermediate layer resin is less than 0.900 g/cm^3, it becomes difficult to process it into a film, and if it exceeds 0.930, a low temperature sealing property becomes worse. Further, if the degree of polydispersion is 3 or higher, the sealing property becomes uneven, tackiness and odor of the film are generated, and the transparency is reduced, whereby excellent characteristics cannot be obtained. In such an instance, it is most preferred to use a resin polymerized by means of zirconocene dichloride and methyl aluminoxane i.e. a metallocene catalyst.

[0008]

The metallocene catalyst is called as a single site

catalyst of which the active sites are uniform, and which is distinguished from a conventional multi-site catalyst such as Zingler-Natta catalyst. In the case of the multi-site catalyst, since it has various types of active sites, the molecular weight distribution is wide and the comonomer content varies depending upon the molecules, such properties as a low temperature heat sealing property and transparency are affected by the wide distribution and naturally worsened. For example, by using LLDPE, it is possible to impart tear resistance and tensile impact resistance to LDPE, but the low temperature sealing property and transparency are worsened. On the other hand, since the active sites of the single site catalyst are uniform, the molecular weight distribution is narrow and the comonomer contents of respective molecules are substantially equal, whereby it is possible to obtain excellent low temperature sealing property and transparency. The side at which the intermediate layer 4 and the outer layer 2 contact with each other, may be if necessary, subjected to a surface treatment such as a corona treatment, a plasma treatment or a sand blast treatment, to improve the adhesion, and put together and adhered by dry laminate or extrusion laminate. The thickness of the intermediate layer is at least 10 μm, preferably 20 to 60 μm. If it is thinner than 10 μm, the effect for tear resistance is lost, and if it is thicker than 60 μm, the heat sealing property is worsened. The adhesive layer 5 is made of a single unit or combination of thermoplastic adhesives of a heat seal lacquer type, selected from a polyurethane type resin, an

acrylic type resin, an ethylene vinyl acetate type resin, a polyvinylchloride type resin, a polyester type resin, a butadiene type resin and a styrene type resin, whereby it has a property that it is heat-sealable to a plastic carrier tape as the subject.

[0009]

At the same time, in the adhesive, an electroconductive fine powder of either thin oxide or zinc oxide is uniformly dispersed. In this instance, the surface resistivity of the adhesive layer after the film formation is required to be at most 10^{13} Ω/□, more preferably 10^{6} Ω/□ to 10^{10} Ω/□. If it is larger than 10^{13} Ω/□, the electrostatic effect is extremely worsened and the desired performance cannot be obtained. Further, the added amount of the adhesive is, in view of the above surface resistivity, 10 to 1,000 parts by weight, more preferably 100 to 300 parts by weight based on 100 parts by weight of the base resin of the adhesive. If it is less than 10 parts by weight, electrostatic-preventing effect is not developed, and if it is larger than 1,000 parts by weight, the dispersibility into the adhesive is significantly worsened, such being unsuitable for production. Further, since the material for electrostatic treatment itself has electroconductivity, the electrostatic effect is semi-permanently imparted, and no bleed or the like is caused, whereby the sealing property is not adversely influenced. And, since the surface resistivity of the adhesive layer is adjusted to be at most 10^{13} Ω/□, even if the electronic components

happen to contact with the cover tape at the time of transportation while sealing the electronic components in the carrier tape with the cover tape, or when the cover tape if peeled off to pick up the electronic components, no static electricity is generated and the electronic components can be protected from the electrostatic hindrance. Here, in order to further increase the electrostatic effect, an antistatic-treating layer or an electroconductive layer may be provided on the outer layer side, namely, the surface and back faces of the biaxially oriented film. Further, as a method for forming a heat sealing type adhesive, both a melt film formation method and a solution film formation method may be used, but preferably the solution film formation method is desirable from the viewpoint of dispersibility of the electroconductive fine powder.

[0010]

Further, in a seal-peel step of the cover tape, first, the cover tape 1 is continuously sealed in a rail-like form with a width of 1 mm each on both sides of the carrier tape 6. (Fig. 3) Next, when the cover tape 1 is peeled off from the carrier tape 6 at the time of peeling, if the adhesion strength between the adhesive layer 5 of the cover tape 1 and the seal face of the carrier tape 6 is smaller than the interlayer adhesion strength between the intermediate layer 4 and adhesive layer 5 of the cover tape 1, the peel-off strength corresponds to the adhesion strength between the adhesive layer 5 of the cover tape 1 and the seal face of the carrier tape 6, and thus the peeling is conducted by an interface peeling which is the most common

peeling mechanism at present. On the other hand, like in the present invention, if the adhesion strength between the adhesive layer 5 of the cover tape 1 and the seal face of the carrier tape 6 is larger than the interlayer adhesion strength between the intermediate layer 4 and adhesive layer 5 of the cover tape 1, only the sealed portion of the formed adhesive layer 5 remains on the carrier tape (Fig. 4), and the cover tape after peeling (Fig. 5) is in such a form that only the heat-sealed portion of the adhesive layer 5 falls off, namely, the peeling is conducted by a so-called transfer peeling. Namely, the peel-off strength corresponds to the interlayer adhesion strength between the adhesive layer 5 and the intermediate layer 4, and the peeling face is incorporated in the cover tape, and its interlayer adhesion strength can be set irrespective of the material of the carrier tape, whereby stable peel-off strength can be obtained without receiving the influence of the sealing condition of the cover tape and the carrier tape. In this instance, the adhesive is selected so that the interlayer adhesion strength between the intermediate layer and adhesive layer of the cover tape will be 10 to 130 gr, more preferably 10 to 70 gr per 1 mm of the width of seal. If the peeling strength is lower than 10 gr, there is a problem that the cover tape happen to be detached at the time of transportation of packaging, whereby the electronic components as the content fall off. On the contrary, if it is higher than 130 gr, a phenomenon i.e. jumping trouble occurs in which the carrier tape vibrates when the cover tape is peeled and the electronic components fall off

out of the accommodating pockets immediately before the mounting. By using this transfer peeling mechanism, it is possible to obtain the desired properties that the dependency on the sealing conditions is low as compared with the conventional interface peeling, and at the same time, the change with the lapse of time of the peel-off strength due to storage environment is small. Further, since the cover tape is constituted so that its total light transmittance is at least 70%, preferably at least 80%, the electronic components sealed in the interior of the carrier tape can be observed with eyes or mechanically. If it is lower than 70%, the electronic components in the interior can hardly be confirmed.

[0011]

Next, in Fig. 2, the outer layer 2 and a second layer 3 at its inside are oriented or non-oriented films of polypropylene or nylon, and films having a thickness of 6 to 50 μm and being transparent and excellent in the impact resistance and tear resistance. If the layer 3 is less than 6 μm in thickness, the tear resistance is insufficient, and if it exceeds 50 μm, the sealing property is instable. By the way, there is a biaxially oriented nylon film as a film being excellent in transparency, heat resistance, tear resistance and impact resistance. However, if it is used for the outer layer, the slip property with a flat iron for heat sealing is poor, whereby it is not suitable for particularly a sliding type sealing machine. Further, since this has a large moisture absorptivity, when it is used for the outer layer, a problem

of blocking will occur and thus it is not suitable for the outer layer. The side at which the outer layer 2 and the layer 3 contact with each other, may, if necessary, be subjected to a surface treatment such as a corona treatment, a plasma treatment or a sand blast treatment to increase the adhesion and put together and adhered by laminate or dry laminate. Further, the intermediate layer 4 and adhesive layer 5 have the same structures as in Fig. 1.

[0012]

[Examples]

Examples of the present invention are shown below. However, it should be mentioned that the present invention is by no means restricted by these examples.

Examples 1 to 7 and Comparative Examples 1 to 5

As identified in the layer construction in Table 1 and Table 2, laminates having a biaxially oriented film as an outer layer and an intermediate layer provided at its inside, and laminates having provided between an outer layer and an intermediate layer, an oriented or non-oriented film being excellent in tear resistance and impact resistance, were prepared. A solution was coated for film formation of an adhesive layer in a thickness of 2 μm, by a roll coater, on one side of the intermediate layer opposite to the side at which the intermediate layer contacts with the outer layer or the intermediate layer contacts with the layer being excellent in tear resistance and impact resistance. Here, the density, melting point, tear strength of film, tensile impact strength

and opaqueness of the resin of the intermediate layer are also identified in Table 1 and Table 2. Further, the type and added amount of the electroconductive fine powder are indicated in the parenthesis after the adhesive layer. The added amount is an amount (parts by weight) to 100 parts by weight of a thermoplastic resin in the adhesive layer. The obtained test samples were slitted to a width of 13.5 mm, and then subjected to heat sealing with a polystyrene carrier tape having a width of 16 mm, followed by judging with respect to the presence or absence of tape breakage by use of a high speed peeling machine (42,000 mm/min) and also measuring a peeling strength (measurement speed: 300 mm/min). Further, the surface resistivity at the adhesive layer side and the visible light transmittance and tensile impact strength of the cover tape test samples were conducted and the results are indicated in Table 3 and Table 4

Heat sealing conditions: 120°C/1 kg/cm^2/1 sec, sliding type seal, seal width: 1mm × 2

Peeling conditions: 180° peeling, peeling speed: 300 mm/min, number of samples: 3

[0013]

The raw materials used are indicated below.

· PE: Polyethylene obtained by using a metallocene catalyst for polymerization

· PET: Polyethylene terephthalate (non-oriented)

· O-PET: Biaxially oriented polyethylene terephthalate

· PP: Polypropylene (non-oriented)

- OPP: Biaxially oriented polypropylene
- NY: Nylon (non-oriented)
- ONY: Biaxially oriented nylon
- EVA: Ethylene vinyl acetate copolymer
- PVC: Polyvinyl chloride
- LDPE: Low density polyethylene
- LLDPE: Straight chain low density polyethylene
- SnO_2: Tin oxide
- ZnO_2: Zinc oxide

[0014]

Table 1

	Examples					
	1	2	3	4	5	6
· Outer layer						
Resin used	O-PET	O-PET	O-PET	OPP	O-PET	OPP
Thickness (μm)	25	12	9	16	12	25
· Second layer						
Resin used	-	ONY	OPP	NY	OPP	-
Thickness (μm)		12	15	15	15	
· Intermediate layer						
Resin used	PE	PE	PE	PE	PE	PE
Thickness (μm)	20	30	50	15	40	30
Density (g/cm^3)	0.905	0905	0.910	0.920	0.915	0.905
Melting point (°C)	90	88	100	105	103	93
Tear strength (kg/cm)	124	145	120	110	130	145
Tensile impact strength (kg-cm/cm^2)	120	125	110	105	107	112
Opaqueness (%)	8	7	13	12	13	10
· Adhesive layer						
Adhesive used	PVC type	Acryl type	PET type	Polyurehtane type	EVA type	Buradiene type
Electroconductive fine powder (Parts by weight)	SnO_2 150	SnO_2 250	ZnO_2 320	ZnO_2 600	SnO_2 900	SnO_2 200

[0015]

Table 2

	Examples	Comparative Example				
	7	1	2	3	4	5
· Outer layer						
Resin used	O-PET	O-PET	OPP	O-PET	OPP	O-PET
Thickness (μm)	16	25	25	16	25	16
· Second layer						
Resin used	ONY	-	-	OPP	-	ONY
Thickness (μm)	12			15		12
· Intermediate layer						
Resin used	PE	LLDPE	-	5%EVA	LLDPE	LDPE
Thickness (μm)	40	30		30	20	40
Density (g/cm^3)	0.910	0.908		0.933	0.915	0.919
Melting point (°C)	102	120		125	125	128
Tear strength (kg/cm)	124	85		45	105	60
Tensile impact strength ($kg\text{-}cm/cm^2$)	120	75		35	100	45
Opaqueness (%)	11	20		13	18	8
· Adhesive layer						
Adhesive used	Styrene type	PET type	Polyurethane type	EVA type	Acryl type	EVA type
Electroconductive fine powder	SnO_2	ZnO_2	SnO_2	SnO_2	Surfactant	SnO_2
(Parts by weight)	400	150	7	1200	2	1500

[0016]

Table 3

	Examples					
	1	2	3	4	5	6
·Breakage of test tape in high speed peeling	Not occurred	Not occurred	Not occurred	Not occurred	Not occurred	Not occurred
·Peeling strength						
Initial value	40	45	30	25	43	52
40°C-90%, 30days	55	45	28	62	38	55
60°C, 30 days	68	50	55	75	80	68
·Type of peeling of adhesive layer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer
·Tensile impact strength ($kg\text{-}cm/cm^2$)	420	505	350	220	430	450
·Surface resistivity (Ω/□)	10^9	10^8	10^6	10^7	10^5	10^8
·Total light transmittance (%)	88.0	85.2	76.3	50.7	25.8	81.0

[0017]

Table 4

	Example	Comparative Examples				
	7	1	2	3	4	5
·Breakage of test tape in high speed peeling	Not occurred	Occurred	Occurred	Not occurred	Occurred	Not occurred
·Peeling strength						
Initial value	25	10	45	5	35	11
40°C-90%, 30days	30	5	15	0	5	2
60°C, 30 days	45	45	150	10	25	15
·Type of peeling of adhesive layer	Transfer	Transfer	Interface	Transfer	Transfer	Transfer
·Tensile impact strength (kg-cm/cm^2)	505	350	220	430	280	550
·Surface resistivity (Ω/□)	10^7	10^{12}	10^{14}	10^4	10^{14}	10^4
·Total light transmittance (%)	74.3	72.6	89.5	45.6	88.0	30.5

[0018]

[Effects of the Invention]

By using the cover tape of the present invention, the following five advantages can be accomplished. Even if high speed mounting of a mounting machine proceeds, there is no risk of occurrence of tape breakage trouble. Since the adhesive layer is already subjected to an electrostatic treatment, static electricity to be generated when the electronic components contact with the cover tape or the cover tape is peeled off, can be suppressed, and at the same time, the sealing properties are not influenced. By the combination of the heat seal lacquer adhesive and the intermediate layer, sealing can be made at a low temperature, and the peel-off strength can optionally be set within a range of 10 to 120 gr per 1 mm. Since the peel-off strength is determined by the adhesion strength between layers in the cover tape, the peel-off strength is not influenced by the sealing conditions with the carrier tape. Since the transparency is excellent, the devices as the incorporated contents can easily be inspected.

By the above five advantages, conventional problems of tape breakage at the time of peeling can be solved, and at the same time, the problem of large dependency of the peel-off strength on the sealing conditions, the problem of the change with the lapse of time depending upon the storage environment, and the problem of generation of static electricity generated when the electronic components contact with the cover tape or at the time of peeling the cover tape, can be solved, whereby

stable peel-off strength can be obtained.

[Brief Explanation of the Drawings]

[Fig. 1]

Cross sectional view showing the layer structure of the cover tape of the present invention

[Fig. 2]

Cross sectional view showing the layer structure of the cover tape of the present invention

[Fig. 3]

Cross sectional view showing a state in use where the cover tape of the present invention is adhered to the carrier tape

[Fig. 4]

Cross sectional view of the cover tape of the present invention showing a state where the cover tape is peeled from the carrier tape

[Fig. 5]

Cross sectional view of the carrier tape showing a state where the cover tape of the present invention is peeled off

Fig. 1

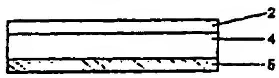


Fig. 2

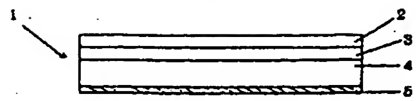


Fig. 3

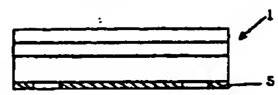


Fig. 4

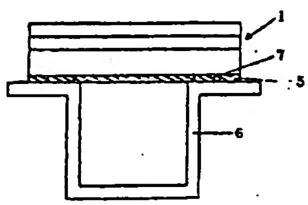
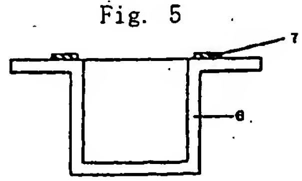


Fig. 5



1: Cover tape, 2: Outer layer, 3: Second layer, 4: Intermediate layer, 5: Adhesive layer, 6: Carrier tape, 7: Heat-sealed portion of adhesive layer